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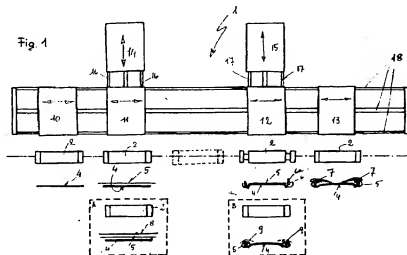
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DE ES FR GB(71) Applicant: **PIRELLI COORDINAMENTO**
PNEUMATICI Società per Azioni
Piazzale Cadorna, 5
I-20123 Milan(IT)(72) Inventor: **Caretta, Renato**
Viale dei Tigli, 16
I-Gallarate (VA)(IT)
Inventor: **Colombani, Bruno**
Via Monterotondo, 17
I-Milan(IT)(74) Representative: **Giannesi, Pier Giovanni et al**
Pirelli S.p.A., Viale Sarca, 222
I-20126 Milano (IT)(54) **Plant for making tyre carcasses for vehicle wheels.**

(57) The plant comprises a plurality of assembling drums (2) moved along a predetermined assembling path. Each drum encounters, according to a pre-established sequence, a number of primary work stations (10, 11, 12, 13) each intended for the application of a respective main component (4, 5, 6, 7) common to a plurality of carcass types included in a predetermined production range. Alternated with the primary stations are auxiliary work stations (14, 15) intended for applying specifically provided accessory components (8, 9), each being envisaged for a

particular carcass type. Each auxiliary station can be removed and replaced by a different station depending on the type of process to be carried out and is movable between a rest position in which it is perpendicularly moved away from the assembling path and a work position in which it is operatively disposed along the assembling path, in order to execute the application of the respective accessory component. The primary work stations (10, 11, 12, 13) can be moved close to and apart from each other along the assembling path.



The present invention relates to a plant for making tyre carcasses for vehicle wheels, comprising a plurality of assembling drums capable of being moved along a predetermined assembling path; a plurality of primary work stations disposed consecutively in side by side relation along said assembling path and each designed to apply, around each individual assembling drum, a main component common to a plurality of carcass types included in a given production range; at least one auxiliary work station disposed along said assembling path and designed to apply, around each individual assembling drum, at least a predetermined accessory component, intended for a specific one of said tyre carcass types.

In is known that in making vehicle tyres, for motor cars for example, the accomplishment of a so-called carcass is first provided, which carcass is achieved by successively assembling several different components.

In the connection it is noted that generally the use of a given number of main components is provided which are common to all carcass types falling within a given production range. There are then accessory components each relating to a specific carcass type included in said range.

In other words, the different carcass types included in a production range can be distinguished from one another depending on the presence thereon of the various accessory components and/or the typology of the accessory components themselves.

By way of example, when carcass for tubeless tyres are to be produced, that is tyres that in use do not require the presence of an inner tube, the main components can be considered to include a so-called "liner" that is a layer of elastomeric air-proof material, a carcass ply, a pair of annular metal elements, commonly referred to as bead cores, around which the opposite ends of the carcass ply are folded, as well as a pair of side pieces made of elastomeric material, extending over the carcass ply at laterally opposite positions. The accessory components may in turn consist of one or more additional carcass plies, one or more reinforcing bands overlying the carcass ply or plies at the areas turned up around the bead cores, and others.

In modern production processes the assembling of the different components is carried out on automated plants including a plurality of assembling drums moved following a precise working sequence in accordance with the manufacturing process to be executed. These plants consist of a plurality of work stations disposed consecutively in side by side relation, each of which lends itself to carry out the application of a predetermined component onto the assembling drums that in turn are brought in front of it.

In particular there are primary work stations intended for application of the main components, which are always active, irrespective of the carcass type being produced. Alternated with the various primary work stations there are one or more auxiliary work stations, intended for application of accessory components, if required. The activation or deactivation state of these auxiliary stations depends on the carcass type in progress of manufacture.

In accordance with the invention it has been found that in order to achieve a very versatile plant offering excellent features of flexibility in use, simple setting up and productivity, the auxiliary work stations should conveniently be quickly replaced by other stations more suitable for the type of process required at the moment, being at the same time adapted to be moved away from the path along which the assembling drums move, when they are to be kept inactive. Said primary work stations too should be movable along the assembling path so as to be moved apart from, and close to each other in order to enable one or more auxiliary stations to be inserted therebetween or removed therefrom. Thus a great simplification in the plant setting up and servicing operations is achieved, along with a reduction in the time required for carrying out the working cycle of the plant when the auxiliary stations are to be held at rest, as well as a great simplification in the operations necessary to adapt the plant to the manufacture of different carcass types.

The present invention in one main aspect relates to a plant for making tyre carcasses for vehicle wheels, comprising a plurality of assembling drums moved along an assembling path providing a number of stop positions, each intended for coinciding with a specific operating step of the carcass manufacturing process, characterized in that at least one auxiliary work station is movable between a rest position in which it is moved away from the assembling path, and a work position in which it is brought onto the assembling path and disposed in an operative condition at one of said stop positions, in order to carry out the application of one accessory component.

Preferably, the movement of the individual auxiliary work stations occurs following a trajectory perpendicular to said assembling path along which the auxiliary work stations operate preferably in alignment with the primary work stations, along a common work axis, advantageously the axis of rotation of the carcass being produced. The common work axis is preferably linear but may be curved or circular.

It is also provided that at least one of said primary stations may be alternately movable, parallelly to the assembling path, between one operating

position, at one of said drum stop positions, and a second position which is shifted in relation to said operating position by an amount not lower than the front bulkness extension of at least an auxiliary work station in order to enable said auxiliary work station to occupy its work position at said drum stop position.

The present invention in a further aspect provides: one primary work station arranged to apply one main component, an elastomeric sealing layer for example, around the individual assembling drums; a second primary work station arranged to apply a second main component, one carcass ply for example, around said elastomeric sealing layer; one auxiliary work station arranged to optionally apply a semifinished additional piece, a second carcass ply for example, around the main carcass ply; a third primary work station arranged to apply a third main component, i.e. to associate a pair of bead cores for example with the opposite edges of the carcass ply or plies; a second auxiliary work station arranged to apply a further semifinished additional piece, a pair of reinforcing bands for example, at laterally opposite positions onto said carcass ply or plies; and a fourth primary work station arranged to add another main component, i.e. to apply a pair of side pieces of elastomeric material for example onto said carcass ply or plies, at laterally opposite positions.

Advantageously, each of said primary work stations is movable parallelly to the assembling path, between one operating position at one stop position of said drums and a second position in which it is moved away from the preceding position by substantially the same measure as the positioning pitch of said drum stop positions.

Further features, and advantages will become more apparent from the detailed description of a preferred embodiment of a plant for making tyre carcasses for vehicle wheels in accordance with the invention, given hereinafter by way of non-limiting example with reference to the accompanying drawings, in which:

- Fig. 1 is a diagrammatic plan view of a plant for producing carcasses in accordance with the invention, also showing the working steps in succession carried out in the different work stations;
- Fig. 2 is a diagrammatic view of one of said assembled carcasses seen in section.

Referring particularly to Fig. 1, a plant for producing tyre carcasses for vehicle wheels in accordance with the present invention has been generally identified by reference numeral 1.

Plant 1 is intended for making a given range of carcass types, in particular carcasses for tyres of the type commonly referred to as tubeless, that is to be used without an inner tube. Said tyre produc-

tion range is comprised of all tyres of different types and sizes that can be made on the same plant, keeping the corresponding equipments unchanged, such as for example the assembling drums, bead core supports, etc. One of these carcasses is shown in Fig. 2 just as an indication, and denoted "C".

Plant 1 comprises a plurality of assembling drums 2 which are guided along a given assembling path providing different stop positions for the drums, at which positions each drum according to a specific operating step of the assembling process undergoes the application of a particular component intended for the achievement of carcass "C". In the particular embodiment shown, all stop positions are conveniently aligned along a common work axis coincident with the axis of the carcass being manufactured.

In known manner, between the different components that are used for the purpose of obtaining the assembled carcass "C", it is possible to identify main components that are common to all carcass types provided in the production range, and accessory components, each of which is specifically intended for a given type of carcass.

In the embodiment shown the main components comprise an airproof layer 4 of elastomeric sealing material commonly referred to as "liner", designed to internally cover or line the finished tyre, a main carcass ply 5 to be disposed over the elastomeric sealing layer 4, a pair of bead cores 6 provided with respective elastomeric fillers 6a to be engaged to the opposite ends of the carcass ply 5 and a pair of side pieces 7 of elastomeric material to be disposed over the carcass ply 5 at axially opposite positions.

The accessory components, in turn, may for example comprise an additional carcass ply 8 to be disposed over the main carcass ply 5 before the bead cores 6 are assembled and a pair of textile or metal reinforcing bands 9 to be disposed over the carcass ply or plies 5, 8 at laterally opposite positions, in the region of the folded portions of said plies, before the assembling of the side pieces 7.

The main components 4, 5, 6, 7 and accessories 8, 9 are sequentially engaged in known manner around the individual assembling drums 2 upon the action of respective primary work stations 10, 11, 12, 13 and auxiliary work stations 14, 15, operating at said drum stop positions.

In greater detail, at a first primary work station 10 the elastomeric airproof layer 4 is wrapped around the individual assembling drums 2.

Following the first primary station 10 there is a second primary work station 11 at which the main carcass ply 5 is wrapped around said drums, so as to overlie the airproof elastomeric layer 4.

Subsequently, the individual assembling drum 2 can be supplied from a first auxiliary assembling station 14, with the additional carcass ply 8 (see box "A" in dotted line in Fig. 1) designed to be disposed so as to overlie the main carcass ply. Then, each assembling drum 2 may be supplied from a third primary work station 12, with the bead cores 6 that are engaged to the carcass ply or plies 5, 8 by folding back the opposite ends of said plies around the bead cores. Afterwards (see box "B" in dotted line in Fig. 1) the activation of the second auxiliary work station 15 may occur, this station being designed to apply the reinforcing bands 9, as well as of a fourth primary work station 13 on which the application of the side pieces 7 relies.

In an original manner, the auxiliary work stations 14, 15 are mounted on respective transverse slide guides 16, 17 and, upon command of actuators not shown as obtainable by any known manner, lend themselves to be individually displaced, preferably following a trajectory substantially perpendicular to the assembling path. The displacement of the individual auxiliary stations 14, 15 takes place between a rest position, in which said stations 14, 15 (as shown in Fig. 1) are moved away from the assembling path, in particular separated therefrom for possible interposition of primary stations 11, 12, and a work position in which they are located along the assembling path, being in alignment with the primary work stations 10, 11, 12, 13, and disposed operatively at one of said drum stop positions, in order to carry out the application of the corresponding accessory components 8, 9.

The possibility of moving the auxiliary work stations 14, 15 away from the assembling path, enabling them to be staggered relative to the primary work stations 10, 11, 12, 13, greatly facilitates the execution of all operations necessary for supplying said stations with the pieces of semifinished products to be assembled on the assembling drums 2, as well as the execution of possible servicing operations and operations tending to replace the supply turrets depending on the type of process to be carried out.

In addition, these supply, replacement and servicing operations are greatly facilitated as regards the primary work stations 10, 11, 12, 13 too, which are disposed adjacent the auxiliary stations 14, 15, by virtue of the free room created as a result of the auxiliary stations being moved to their rest position.

Preferably said auxiliary stations (14, 15) are located along the assembling path at the position made free by at least one of said primary work stations (11, 12), which is mounted in an original manner on respective longitudinal slide guides 18 extending parallelly to the assembling path and has been previously moved away from its work posi-

tion, parallelly to the assembling path, by an amount not lower than the front bulkiness extension of the auxiliary work stations, in order to enable access of said stations to the respective work position, at the drum stop position.

According to a preferential aspect of the invention, each of the primary work stations 10, 11, 12, 13 is given this shifting possibility through said longitudinal slide guides 10: all stations can therefore be moved parallelly to the assembling path, between one operating position and a second position displaced sideways with respect to said first position. In addition and preferably the translation amount is substantially equal to the positioning pitch of the drum stop positions. It is therefore advantageously possible to move the primary work stations 10, 11, 12, 13 close to and away from each other.

In this way when the auxiliary stations must be brought from the rest position they occupy to the operating position, the primary work stations can be moved parallelly to the assembling path in order to enable access of the auxiliary stations to said path.

When for example, with reference to Fig. 1, the auxiliary station 14 need to be used for application of the additional component 8, the primary station 11 adjacent the auxiliary station 14 is moved sideways close to or away from the primary station 10 over a length at least equal to the front bulkiness extension of the auxiliary station 14 and preferably substantially corresponding to the positioning pitch of the drum stop positions, to enable the station 14 to gain access onto the assembling path.

Obviously the same as above also applies with reference to the primary work station 12 for the activation and deactivation of the second auxiliary work station 15.

It is of course possible, depending on the specific plant topography, to simultaneously move apart two adjacent primary stations in opposite directions in order to enable the auxiliary station lying behind to enter the area thus let free between said primary stations.

The mobility of the work stations parallelly to the assembling path also enables two different stations to work alternately at the same drum stop position.

As a result, the plant of the invention lends itself to be adapted in a very quick and easy manner to the specific assembling process suitable for the different carcass types.

It will be also recognized that the possibility of moving the individual primary work stations 10, 11, 12, 13 apart from each other offers the advantage of further facilitating the setting up and servicing operations to be carried out on said stations.

The assembled carcasses "C" in the manufacturing plant 1 must be then submitted at least to the application of a so-called "belt pack" and of a tread band before undergoing a vulcanization process for the purpose of obtaining a finished tyre.

This additional step is carried out in an usual manner following working processes and using plants commonly known to those skilled in the art.

In particular, these plants may be directly connected to the plant of the invention such as to accomplish an independent operating sequence producing tyres ready for vulcanization without solution of continuity from the semifinished product to the finished tyre.

Alternatively, carcasses produced on the plant of the invention can be sent to a store from which they will be subsequently withdrawn for supply to the separate plant carrying out the tyre completion through assembling of the belt pack 8 and tread band.

The tyre thus completed is ready for undergoing the final vulcanisation step.

The invention attains important advantages.

From the above description it is in fact possible to assume that the possibility of moving the auxiliary work stations away from the assembling path and moving the individual primary stations 10, 11, 12, 13 close to and away from each other makes the setting up and servicing of the manufacturing plant in question very easy, and above all offers an excellent flexibility of use of the same.

In fact the auxiliary stations 14, 15 can be replaced whenever necessary in order to meet any specific types of process and supplied with the respective appropriate accessory components (additional plies 5, reinforcing bands 9 or others) in a very easy manner and without requiring the plant operation to be stopped, as they can be set in operation on the assembling path at any desired moment.

Each auxiliary station 14, 15 may also be advantageously provided with an electrofluidic control and drive unit managing the operation thereof and adapted to be connected with the electronic unit managing the operation of the whole plant 1 merely through electric and fluidic connectors to be activated at the moment that the corresponding auxiliary station is brought to the operating condition.

Advantageously, the auxiliary work stations can be also utilized in place of one or more of the primary work stations, in order to avoid the operation of the plant being stopped during the setting and/or servicing of the primary stations themselves.

The auxiliary work stations can in addition be conceived as removable and replaceable units in order to enable the setting up and/or servicing operations to be carried out at areas different from

the ones where the plant is installed or for the purpose of serving a plurality of plants taking advantage of the different assembling processes simultaneously carried out on said plants.

Obviously many modifications and variations may be made to the invention as conceived without departing from the scope of the inventive idea characterizing it. For example also one or more of the primary stations may be conceived so as to be moved away from the assembling path, in the same manner as described with reference to the auxiliary stations.

Claims

1. A plant for making tyre carcasses for vehicle wheels, comprising:
 - a plurality of assembling drums (2) moved along an assembling path provided with a number of stop positions, each intended for coinciding with a specific operating step of the manufacturing process of said carcasses;
 - a plurality of primary work stations (10, 11, 12, 13) disposed consecutively in side by side relation along said assembling path and each designed to apply, around each individual assembling drum (2), at said stop positions, a main component (4, 5, 6, 7) common to a plurality of carcass (C) types included in a given production range;
 - at least one auxiliary work station (14, 15) disposed along said assembling path and designed to apply, around each individual assembling drum (2), one predetermined accessory component (8, 9), intended for a specific one of said tyre carcass (C) types included in said production range,
 characterized in that said at least one auxiliary work station (14, 15) is movable between a rest position in which it is moved away from the assembling path, and a work position in which it is brought onto the assembling path and disposed in an operative condition at one of said drum stop positions, in order to carry out the application of said accessory component.
2. A plant according to claim 1, characterized in that said at least one auxiliary work station (14, 15) is movable according to a direction substantially perpendicular to the assembling path.
3. A plant according to claim 1, characterized in that said at least one auxiliary work station (14, 15) in said work position in which it is located

along the assembling path, is in alignment with the primary work stations (10, 11, 12, 13), along a common work axis.

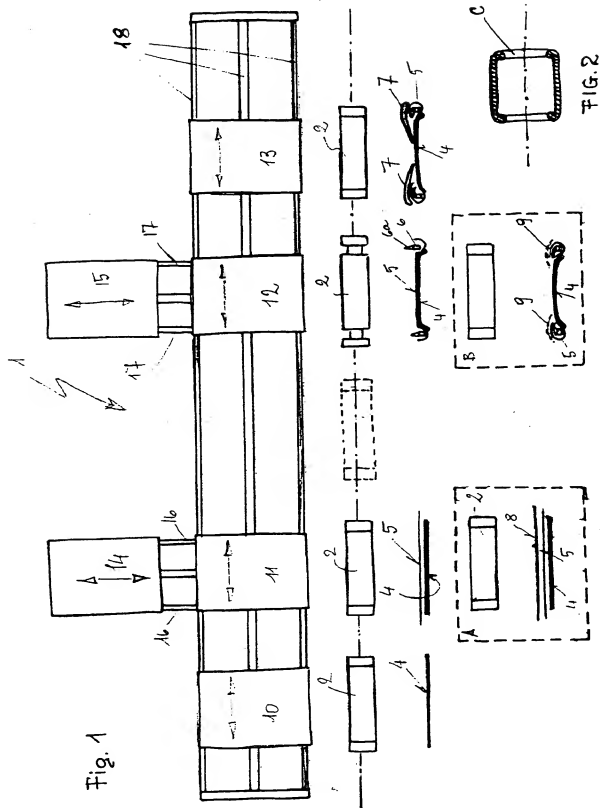
8. A plant according to claim 1 characterized in that said assembling path is linear.

4. A plant according to claim 1, characterized in that at least one of said primary stations (10, 11, 12, 13) is movable parallelly to the assembling path, alternately between one operating position at one of said drum stop positions and a second position which is shifted in relation to said operating position by an amount not lower than the front bulkiness extension of at least one auxiliary work station in order to enable said auxiliary work station to occupy its work position at said drum stop position.

5. A plant according to claim 1, characterized in that it comprises:

- one primary work station (10) arranged to apply an elastomeric sealing layer (4) around the individual assembling drums (2);
- a second primary work station (11) arranged to apply one main carcass ply (5) around said elastomeric sealing layer (4);
- one auxiliary work station (14) arranged to optionally apply a semifinished additional piece (8) around the main carcass ply (5);
- a third primary work station (13) arranged to associate a pair of bead cores (6) with the opposite edges of the carcass ply (8);
- a second auxiliary work station (15) arranged to apply a further semifinished additional piece to said carcass ply (5); and
- a fourth primary work station (13) arranged to apply a pair of side pieces of elastomeric material (7) to said carcass ply (5), at laterally opposite positions.

6. A plant according to claim 5, characterized in that each of said primary work stations (10, 11, 12, 13) is movable parallelly to the assembling path, between one operating position, at one stop position of said drums, and a second position in which it is moved away from the preceding position by substantially the same amount as the positioning pitch of said drum stop positions.
7. A plant according to anyone of the preceding claims, characterized in that said common work axis is the axis of rotation of said assembling drums.





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DOCUMENTS CONSIDERED TO BE RELEVANT

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X A	EP-A-0 067 788 (MITSUBISHI JUKOGYO K.K.) * page 19, line 23 - page 22, line 7; figures 1,2 * -----	1-3,7,8 4-6	B29D30/08
X A	US-A-4 053 342 (P. E. APPLEBY ET AL.) * column 3, line 65 - column 4, line 12 * * column 8, line 39 - column 9, line 16; figures 1,2 * * column 9, line 57 - line 66 * -----	1-3,7 4-6,8	
X A	EP-A-0 246 497 (THE FIRESTONE TIRE & RUBBER COMP.) * page 17, line 20 - page 21, line 25; figures 1,3 * -----	1,8 2-7	
X A	US-A-3 389 032 (S. A. BLACK ET AL.) * column 10, line 47 - column 14, line 66; figure 1 * * column 208, line 60 - column 209, line 13 * * claim 1 * -----	1 2-8	
A	US-A-3 318 745 (S. A. BLACK ET AL.) * column 8, line 56 - column 10, line 17; figure 1 * * column 52, line 63 - column 65, line 75; figures 89,90,99-110 * -----	1-8	
A	EP-A-0 004 202 (NRM CORPORATION) * page 2, line 24 - page 3, line 4 * * page 6, line 1 - line 26 * * page 20, line 1 - line 27 * * figure 1.2 * -----	1-8	B29D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 03 MAY 1993	Examiner FREGOSI A.M.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- * : number of the same patent family, corresponding document	



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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	GB-A-2 223 988 (APSLEY METALS) * page 11, line 23 - page 13, line 19; figure 6 *	1-8	
A	EP-A-0 448 407 (BRIDGESTONE CORP.) * the whole document	1-8	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 03 MAY 1993	Examiner FREGOSI A.M.
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons A : technological background O : non-written disclosure P : intermediate document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		A : member of the same patent family, corresponding document	

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